

Claims

We claim:

*Sub B1*

1. The method of exchanging unmodulated digital signals between digital signal apparatus, including computers, over a single conductor coaxial cable simultaneously with broadband transmission of RF modulated video signals between video signal apparatus over the same cable, the video apparatus including one or more video signal sources and one or more video signal receivers, the coaxial cable having a cable characteristic impedance, the method comprising:

10 establishing a plurality of signal frequency channels, including an RF video signal channel and a PC digital signal channel, each frequency channel having a different frequency range;

15 connecting the signal input and output (I/O) ports of each digital signal apparatus to a first terminal of a digital signal frequency filter, a second terminal of which is connected to the coaxial cable, said digital signal frequency filter having a frequency passband which is substantially equal to the frequency range of said PC digital signal channel, said digital signal frequency filter providing a substantially equal filter characteristic impedance to unmodulated digital signals exchanged bi-directionally, at a signal bit speed, between said first terminal and said second terminal; and

20 connecting each RF modulated video signal apparatus to the cable through an RF video signal frequency filter having a frequency passband which is substantially equal to the frequency range of said RF video signal channel, said RF video signal frequency filter providing a substantially equal filter characteristic impedance to RF modulated video signals propagating bi-directionally therethrough between the RF modulated video signal apparatus and the cable.

2. The method of claim 1; wherein said step of establishing further includes

the step of assigning a lower range of signal frequency values to said PC digital signal channel than to said RF video signal channel.

3. The method of claim 1, wherein said first step of connecting further includes the step of:

inserting a impedance matching network between the digital signal apparatus signal I/O ports and said first terminal of said digital signal frequency filter, said impedance matching network providing a terminating impedance value at said first terminal which approximates the cable characteristic impedance provided by the coaxial cable to said second terminal, thereby providing said substantially equal filter characteristic impedance to unmodulated digital signals exchanged bi-directionally, at a signal bit speed, through said digital signal frequency filter.

4. The method of claim 3, wherein said step of inserting further includes: providing said impedance matching network as a series resistor functionally connected at first and second ends thereof to said first terminal and to the digital signal apparatus signal I/O ports, respectively, said series resistor further connected at said second end through a shunt resistor to the low voltage potential signal reference of the digital signal apparatus signal I/O ports.

5. The method of claim 4, wherein said shunt resistor has a shunt impedance value which is substantially equal to the value of the cable characteristic impedance, and wherein said series resistor has a series impedance value which is in the range of from one third to two thirds of said shunt impedance value.

6. The method of claim 1, wherein said digital signal frequency filter is at least a third order filter.

7. The method of claim 1, wherein said RF video signal frequency filter is

at least a third order filter.

8. The method of claim 1, wherein said digital signal frequency filter is at least a fifth order filter.

9. The method of claim 2, wherein said PC digital signal channel frequency range is substantially from zero hertz to 2.5 megahertz and said RF video signal channel frequency range is greater than five megahertz.

10. The method of claim 3, wherein said signal bit speed of the unmodulated digital signal is a minimum of substantially 1.0 Mbps.

11. The method of claim 5, wherein said series impedance value is selected at a value within said range to minimize interference of the unmodulated digital signals with the RF modulated video signals.

12. The method of exchanging unmodulated digital signals between digital signal apparatus over a single conductor coaxial cable simultaneously with broadband transmission of RF modulated video signals between video signal apparatus over the same cable, the video apparatus including one or more video signal sources and one or more video signal receivers, the coaxial cable having a cable characteristic impedance, the method comprising:

establishing a plurality of signal frequency channels, including a PC digital signal channel having a frequency range substantially from zero hertz to 2.5 megahertz and an RF video signal channel having a frequency range substantially at five megahertz and above;

connecting the signal input and output (I/O) ports of each digital signal apparatus through an impedance matching network to a first terminal of a digital signal frequency filter, a second terminal of which is connected to the coaxial cable, said digital signal frequency filter having a frequency passband which is substantially equal to the frequency range of said PC digital signal channel to

5

10

15

Sub  
B2

provide for bi-directional exchange of unmodulated digital signals between the coaxial cable and the I/O ports of the digital signal apparatus, said impedance matching network providing a terminating impedance value at said first terminal which approximates the cable characteristic impedance provided by the coaxial cable to said second terminal, to provide said bi-directional exchange of unmodulated digital signals at a minimum signal bit speed of substantially 1.0 Mbps; and

connecting each RF modulated video signal apparatus to the cable through an RF video signal frequency filter having a frequency passband which is substantially equal to the frequency range of said RF video signal channel, said RF video signal frequency filter providing a substantially equal filter characteristic impedance to RF modulated video signals propagating bi-directionally therethrough between the RF modulated video signal apparatus and the cable.

13. Apparatus for exchanging unmodulated digital signals between digital signal apparatus, including computers, over a single conductor coaxial cable simultaneously with broadband transmission of RF modulated video signals between video signal apparatus over the same cable, the video apparatus including one or more video signal sources and one or more video signal receivers, the coaxial cable having a cable characteristic impedance, the apparatus comprising:

a plurality of digital signal frequency filters, one each associated with each digital signal apparatus, each said digital signal frequency filter having a first terminal adapted for signal connection to the signal input and output (I/O) ports of the associated digital signal apparatus and having a second terminal adapted for signal connection to the coaxial cable, each said digital signal frequency filter having a frequency passband suitable to pass the unmodulated digital signals therethrough, bi-directionally between the digital signal apparatus and the coaxial cable, at a selected signal bit speed and at a substantially equal,

bi-directional filter characteristic impedance; and  
20 a plurality of RF video signal frequency filters, one each associated with  
each RF modulated video signal apparatus, each said RF video signal frequency  
filter having a first terminal adapted for signal connection to the signal I/O ports  
of the associated RF modulated video signal apparatus and having a second  
terminal adapted for signal connection to the coaxial cable, said RF video signal  
frequency filters having a frequency passband suitable to pass the RF modulated  
video signals therethrough, bi-directionally between the video signal apparatus  
25 and the coaxial cable.

14. The apparatus of claim 13; wherein the passband of said RF modulated  
video signal filter is at a higher frequency spectrum than the passband of said  
digital signal filter.

15. The apparatus of claim 13, further comprising:  
5 a plurality of impedance matching networks, one each inserted between  
the digital signal apparatus signal I/O ports and said first terminal of said digital  
signal frequency filter, said impedance matching network providing a  
terminating impedance value at said first terminal which approximates the cable  
characteristic impedance provided by the coaxial cable to said second terminal,  
thereby providing said substantially equal filter characteristic impedance to  
unmodulated digital signals exchanged bi-directionally, at a signal bit speed,  
10 through said digital signal frequency filter.

16. The apparatus of claim 15, wherein each said impedance matching  
network comprises:

5 a series resistor functionally connected at first and second sides thereof  
to said first terminal and to the digital signal apparatus signal I/O ports,  
respectively, said series resistor also connected at said second side through a  
shunt resistor to the low voltage potential reference of the digital signal

apparatus signal I/O ports.

17. The apparatus of claim 16, wherein said shunt resistor has a shunt impedance value which is substantially equal to the value of the cable characteristic impedance, and wherein said series resistor has a series impedance value which is in the range of from one third to two thirds of said shunt impedance value.  
5
18. The apparatus of claim 13, wherein said digital signal frequency filter is at least a third order filter.
19. The apparatus of claim 13, wherein said RF video signal frequency filter is at least a third order filter.
20. The apparatus of claim 13, wherein said digital signal frequency filter is at least a fifth order filter.
21. The apparatus of claim 14, wherein the frequency passband of said digital signal filter is substantially from zero hertz to 2.5 megahertz and the frequency passband of said RF video signal filter is greater than five megahertz.
22. The apparatus of claim 15, wherein said signal bit speed of the unmodulated digital signal is a minimum of substantially 1.0 Mbps.
23. The apparatus of claim 17, wherein said series impedance value is selected at a value within said range to minimize digital signal interference with the ~~RF modulated video signals~~.
24. Apparatus for exchanging unmodulated digital signals between digital signal apparatus over a single conductor coaxial cable simultaneously with

Sub  
b3

broadband transmission of RF modulated video signals between video signal apparatus over the same cable, the video apparatus including one or more video signal sources and one or more video signal receivers, the coaxial cable having a cable characteristic impedance, the apparatus comprising:

5 a plurality of digital signal frequency filters, one each associated with each digital signal apparatus, each said digital signal frequency filter having a 10 first terminal adapted for signal connection through a impedance matching network to the signal input and output (I/O) ports of the associated digital signal apparatus and having a second terminal adapted for signal connection to the coaxial cable, each said digital signal frequency filter having a frequency passband substantially from zero hertz to 2.5 megahertz so as to pass the 15 unmodulated digital signals bi-directionally therethrough, between said first and second terminals;

20 a plurality of impedance matching networks, one each inserted between the signal I/O ports of an associated digital signal apparatus and said first terminal of an associated one of said digital signal frequency filters, said 25 impedance matching network providing a terminating impedance value at said first terminal of said associated digital signal frequency filter which approximates the cable characteristic impedance provided to said second terminal of said filter, to provide a substantially balanced filter characteristic impedance to unmodulated digital signals exchanged bi-directionally through said digital signal frequency filter at a minimum signal bit speed of substantially 1.0 Mbps; and

30 a plurality of RF video signal frequency filters, one each associated with each RF modulated video signal apparatus, each said RF video signal frequency filter having a first terminal adapted for signal connection to the signal I/O ports of the associated RF modulated video signal apparatus and having a second terminal adapted for signal connection to the coaxial cable, said RF video signal frequency filters having a frequency passband beginning substantially at five megahertz and increasing to an upper frequency limit suitable to pass the RF

modulated video signals bi-directionally therethrough, between the video signal  
35 apparatus and the coaxial cable.

*Sub A7*

25. The method for distributing radio frequency (RF) modulated broadcast television signals from a broadcast signal source to networked appliances connected to the source through a plurality of single conductor coaxial cables, and simultaneously therewith distributing signals exchanged between the networked appliances over the same coaxial cables, the exchanged signals including RF modulated video signals from RF modulated video signal appliances and unmodulated digital from digital signal appliances, the coaxial cable having a cable characteristic impedance, the method comprising:

10       installing multi-drop signal distribution apparatus having a source input for receiving the RF modulated broadcast television signals from the broadcast source and having a plurality of output signal ports for receiving the RF modulated video signals and unmodulated digital signals from each of the plurality of coaxial cables;

15       coupling the RF broadcast signals within said signal distribution apparatus, from said source input to each said output port;

          coupling the RF modulated video signals and the unmodulated digital signals received at each said output port to each other output port; without port-to-port signal isolation; and

20       connecting each appliance to its associated coaxial cable through an associated one of a plurality of signal frequency filters, including a digital signal frequency filter having a frequency passband suitable to pass therethrough the unmodulated digital signals at a selected signal bit speed, and including an RF modulated video signal filter having a frequency passband suitable to pass therethrough the RF modulated broadcast television signals and the RF modulated video signals, each said filter being connected at a first terminal thereof to the associated appliance and connected at a second terminal thereof to the associated coaxial cable, each said providing a substantially equal filter

characteristic impedance to passband signals propagating bi-directionally  
30 therethrough between the associated appliance and the coaxial cable.

2 26. The method of claim 25, wherein the passband of said RF modulated  
video signal filter is at a higher frequency spectrum than the passband of said  
digital signal filter.

4 27. The method of claim 25, wherein the step of connecting further includes  
5 the steps of:

identifying each digital signal appliance and each associated digital  
signal frequency filter; and

inserting a filter impedance matching network intermediate to the  
connection between each digital signal appliance and said first terminal of said  
associated digital signal frequency filter, said filter impedance matching  
network providing a terminating impedance value at said first terminal which  
10 approximates the cable characteristic impedance provided to said second  
terminal, thereby providing substantially equal filter characteristic impedance to  
unmodulated digital signals exchanged at a signal bit speed, bi-directionally,  
through said digital signal frequency filter.

5 28. The method of claim 27, wherein said step of inserting further includes  
4 the step of:

providing said impedance matching network as a series resistor  
5 functionally connected at a first side thereof to said first terminal of said digital  
signal filter and connected at a second side thereof to the digital signal  
appliance, said series resistor being further connected at said second side  
through a shunt resistor to the low voltage potential reference of the digital  
signal appliance.

6 29. The method of claim 28, wherein said shunt resistor has a shunt  
5

5 impedance value which is substantially equal to the value of the cable characteristic impedance, and wherein said series resistor has a series impedance value which is in the range of from one third to two thirds of said shunt impedance value.

9

1

30. The method of claim 25, wherein said digital signal frequency filter is at least a third order filter.

10

1

31. The method of claim 25, wherein said digital signal frequency filter is at least a fifth order filter.

3

2

32. The method of claim 26, wherein the frequency passband of said digital signal filter is substantially from zero hertz to 2.5 megahertz and the frequency passband of said RF video signal filter is greater than five megahertz.

8

4

33. The method of claim 27, wherein said signal bit speed of the unmodulated digital signal is a minimum of substantially 1.0 Mbps.

7

6

34. The method of claim 29, wherein said series impedance value is selected at a value within said range to minimize digital signal interference with the RF modulated video signals.

5

11

1

35. The method of claim 25, wherein said step of installing further includes the step of blocking the RF modulated video signals and unmodulated digital signals received at said output signal ports from being coupled to said source input.

10

12

1

36. The method of claim 25, wherein said step of installing includes inserting, at each said output port, an associated distribution apparatus impedance matching network connected in series between the associated said

output port and said source input, for providing a terminating impedance value at each said output port which approximates the cable characteristic impedance.

*Sub A27*

37. The method for distributing radio frequency (RF) modulated broadcast television signals from a broadcast signal source to networked appliances connected to the source through a plurality of single conductor coaxial cables, while simultaneously distributing signals exchanged between the networked appliances over the same coaxial cables, the exchanged signals including RF modulated video signals from RF modulated video signal appliances and unmodulated digital from digital signal appliances, the coaxial cable having a cable characteristic impedance, the method comprising:

installing multi-drop signal distribution apparatus having a source input for receiving the RF modulated broadcast television signals from the broadcast source and having a plurality of output signal ports, each output signal port receiving the RF modulated video signals and unmodulated digital signals from an associated one of the plurality of coaxial cables;

coupling the RF broadcast signals within said signal distribution apparatus, from said source input to each said output port;

coupling the RF modulated video signals and the unmodulated digital signals received at each said output port to each other output port; without port-to-port signal isolation;

connecting each appliance to its associated coaxial cable through one of a plurality of signal frequency filters, each said filter being connected at a first terminal thereof to the associated appliance and connected at a second terminal thereof to the associated coaxial cable, said plurality of signal filters including digital signal frequency filters having a frequency passband substantially from zero hertz to 2.5 Megahertz, suitable to pass therethrough unmodulated digital signals between a digital signal appliance and the coaxial, said plurality of signal filters further including RF modulated video signal filters having a frequency passband greater than five megahertz, suitable to pass therethrough

the RF modulated broadcast television signals and the RF modulated video signals between an RF modulated video signal appliance and the coaxial cable, each said providing a substantially equal filter characteristic impedance to passband signals propagating bi-directionally therethrough between the 5 associated appliance and the coaxial cable; and

inserting an impedance matching network between the signal input and output (I/O) ports of each digital signal appliance and said first terminal of said associated digital signal frequency filter, said impedance matching network providing a terminating impedance value at said first terminal which 10 approximates the cable characteristic impedance provided to said second terminal, thereby providing said bi-directional exchange of unmodulated digital signals at a minimum signal bit speed of substantially with minimum digital signal interference of the RF modulated video signals.

38. Apparatus for distributing radio frequency (RF) modulated broadcast television signals from a broadcast signal source to networked appliances connected to the source through a plurality of single conductor coaxial cables 5 and, concurrently and alternately therewith, distributing signals exchanged between the networked appliances over the same coaxial cables, the exchanged signals including RF modulated video signals from RF modulated video signal appliances and unmodulated digital from digital signal appliances, the coaxial cable having a cable characteristic impedance, the apparatus comprising:

10 multi-drop signal distribution apparatus, having a source input adapted for receiving the RF modulated broadcast television signals from the broadcast source and having a plurality of output signal ports, each adapted for receiving the RF modulated video signals and unmodulated digital signals from an associated one of the plurality of coaxial cables, said signal distribution 15 apparatus coupling the RF broadcast television signals from said source input to each said output port and coupling the RF modulated video signals and the unmodulated digital signals received at each said output port to each other

~~output port;~~

20      a plurality of digital signal frequency filters, each adapted for connection at a first terminal thereof to the signal input and output (I/O) of a related one of the digital signal appliances and adapted at a second terminal thereof for connection to the networked appliance associated coaxial cable, each said digital signal frequency filter having a frequency passband suitable to pass unmodulated digital signals therethrough at a selected signal bit speed between 25      the digital signal appliance and the coaxial cable; and

30      a plurality of RF modulated video signal frequency filters, each adapted for connection at a first terminal thereof to the signal (I/O) of a related one of the RF modulated video signal appliances and adapted at a second terminal thereof for connection to the networked appliance associated coaxial cable, each said RF modulated video signal filter having a frequency passband suitable to pass the RF modulated broadcast television signals and the RF modulated video signals bi-directionally therethrough between the associated appliance and the ~~coaxial cable~~.

39.      The apparatus of claim 38, wherein the passband of said RF modulated video signal filters is at a higher frequency spectrum than the passband of said digital signal filters.

D

40.      The apparatus of claim 38, further comprising:

5      a plurality of impedance matching networks, one each inserted between the digital signal apparatus signal I/O ports and said first terminal of said digital signal frequency filter, said impedance matching network providing a terminating impedance value at said first terminal which approximates the cable characteristic impedance provided by the coaxial cable to said second terminal, thereby providing said substantially equal filter characteristic impedance to 10      unmodulated digital signals exchanged bi-directionally, at a signal bit speed, through said digital signal frequency filter.

41. The apparatus of claim 40, wherein each said impedance matching network comprises:

a series resistor functionally connected at first and second sides thereof to said first terminal and to the digital signal apparatus signal I/O ports, respectively, said series resistor being further connected at said second side through a shunt resistor to the low voltage potential reference of the digital signal apparatus signal I/O ports.

5 42. The apparatus of claim 41, wherein said shunt resistor has a shunt impedance value which is substantially equal to the value of the cable characteristic impedance, and wherein said series resistor has a series impedance value which is in the range of from one third to two thirds of said shunt impedance value.

5 43. The apparatus of claim 38, wherein said digital signal frequency filter is at least a third order filter.

44. The apparatus of claim 38, wherein said RF video signal frequency filter is at least a third order filter.

45. The apparatus of claim 38, wherein said digital signal frequency filter is at least a fifth order filter.

46. The apparatus of claim 39, wherein the frequency passband of said digital signal filter is substantially from zero hertz to 2.5 megahertz and the frequency passband of said RF video signal filter is greater than five megahertz.

47. The apparatus of claim 40, wherein said signal bit speed of the unmodulated digital signal is a minimum of substantially 1.0 Mbps.

5 48. The apparatus of claim 41, wherein said series impedance value is

selected at a value within said range to minimize digital signal interference with the RF modulated video signals.

*Sub A3* >  
49. Apparatus, for distributing radio frequency (RF) modulated broadcast television signals from a broadcast signal source to networked appliances

distributed in selected locations and connected to the source through associated ones of a plurality of single conductor coaxial cables, and for also distributing, concurrently and alternately therewith in response to infrared (IR) command signals received from IR signal sources controlled by an operator, signals exchanged between the networked appliances over the same coaxial cables, the exchanged signals including RF modulated video signals from RF modulated video signal appliances, unmodulated digital from digital signal appliances, and the received IR command signals, the different type appliances and the source of IR command signals each having different operating signal frequency ranges, the coaxial cable having a cable characteristic impedance, the apparatus comprising:

15 a plurality of IR transceivers, at least one located in line-of-sight proximity to the networked appliances in each selected area, each said IR transceiver responsive to IR command signals received through the air from IR signal sources in the area for providing an equivalent electrical command signal thereof, and each transmitting IR command signals through the air to appliances 20 in the area in response to equivalent electrical command signals received thereby;

25 a plurality interface apparatus, one each associated with one or more appliances and IR transceivers within a selected area, said interface apparatus having a digital signal frequency filter, an electrical command signal frequency filter, and an RF modulated video signal frequency filter, each having a different bandpass frequency which encompass the different operating signal frequency ranges of the unmodulated digital signals, the electrical command signals, and the RF modulated television signals and video signals, respectively; said digital

30 signal frequency filter being interconnected at first and second terminals thereof  
between the signal input and output (I/O) ports of a digital signal appliance and  
the coaxial cable, said electrical command signal frequency filter being  
interconnected at first and second terminals thereof between an IR transceiver  
and the coaxial cable, and said RF modulated video signal frequency filter being  
interconnected at first and second terminals thereof between the signal I/O ports  
35 of an RF modulated video signal appliance and the coaxial cable, wherein each  
said frequency filter bi-directionally couples operating signals within their  
respective bandpass frequencies between the associated appliance and the  
coaxial cable; and

40 a signal distribution unit, having a source input for receiving the RF  
modulated broadcast television signals, and having a plurality of output signal  
ports for receiving the unmodulated digital signals, the electrical command  
signals, and the RF modulated video signals provided through an associated one  
of the coaxial cables from each of said interface apparatus, said signal  
distribution unit coupling the RF broadcast television signals from said source  
45 input to each said output port and coupling the unmodulated digital signals, the  
electrical command signals, and the RF modulated video signals received at  
each said output port to each other said output port.

50 50. The apparatus of claim 49, wherein said interface apparatus further  
includes an interface impedance matching network interconnected between the  
digital signal appliance signal I/O ports and said first terminal of said digital  
signal frequency filter, said interface impedance matching network  
providing a terminating impedance value at said first terminal which  
approximates the cable characteristic impedance provided by the coaxial cable  
55 to said second terminal, thereby providing said substantially equal filter  
characteristic impedance to unmodulated digital signals exchanged bi-  
directionally, at a signal bit speed, through said digital signal frequency filter.

51. The apparatus of claim 50, wherein each said interface impedance matching network comprises:

5 a series resistor functionally connected at first and second sides thereof to said first terminal and to the digital signal appliance signal I/O ports, respectively, said series resistor being further connected at said second side through a shunt resistor to the low voltage potential reference of the digital signal appliance signal I/O ports.

52. The apparatus of claim 51, wherein said shunt resistor has a shunt impedance value which is substantially equal to the value of the cable characteristic impedance, and wherein said series resistor has a series impedance value which is in the range of from one third to two thirds of said shunt impedance value.

53. The apparatus of claim 52, wherein said series impedance value is selected at a value within said range to minimize digital signal interference with the RF modulated video signals.

54. The apparatus of claim 50, wherein said signal distribution unit further includes:

10 a signal distribution bus connected for response to said source input and to each of said plurality of output ports, for distributing said RF modulated broadcast television signals to each said output port, and for distributing the unmodulated digital signals, the electrical commands signals, and the RF modulated video signals received at each output port from the port connected coaxial cable, to each other output port; and

15 a plurality of distribution unit impedance matching networks, one each connected between an associated one of said plurality of output ports and said distribution unit signal bus, for providing a terminating impedance value at each said output port which approximates the cable characteristic impedance.

55. The apparatus of claim 54, wherein said signal distribution bus has a maximum physical length which is selected to prevent standing wave signal interference of the apparatus distributed signals.

5

56. The apparatus of claim 55, wherein said signal distribution bus maximum physical length is less than a quarter wavelength of the highest frequency distributed signal.

D

10 57. The apparatus of claim 49, wherein the frequency passband of said digital signal filter is substantially from zero hertz to 2.5 megahertz, the frequency passband of said electrical command signal filter is substantially from 2.4 megahertz to 5.0 megahertz, and the frequency passband of said RF video signal filter is greater than five megahertz.

15

58. The apparatus of claim 49, wherein said digital signal frequency filter is at least a third order filter.

59. The apparatus of claim 49, wherein said RF video signal frequency filter is at least a third order filter.

5

60. The apparatus of claim 49, wherein said electrical command signal frequency filter is at least a third order filter.

A2A4